Non-destructive and fast method of mapping the distribution of the soluble solids content and pH in kiwifruit using object rotation near-infrared hyperspectral imaging approach

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Abstract

This work aimed to offer a non-destructive and fast approach to visualizing the soluble solids content (SSC) and acidity (pH) of the whole kiwifruit. Most of the visible-near-infrared spectral imaging techniques used in postharvest fruit and vegetables assessment exhibit issues related to the identification of the quality spatial distribution within intact samples, mainly due to sampling surface curvature effects. Here, a push-broom-type NIR hyperspectral imaging camera and a sample rotation stage were combined to scan entire kiwifruit surfaces. Then, key wavelengths in the range of 1002–2300 nm were extracted for constructing SSC and pH calibration models by partial least squares regression analysis. The resulting SSC prediction accuracy was sufficiently high: the coefficient of determination (R^2_{cv}) and the root mean square error ($RMSE_{cv}$) of cross-validation set were 0.74 and 0.7 %, respectively. For pH, the R^2_{cv} and $RMSE_{cv}$ were 0.64 and 0.14, respectively. Finally, the SSC and pH 360°mapping results surpassed earlier works in this area that they showed a distinct spatial distribution within each intact sample. It was concluded that the proposed object rotation hyperspectral imaging approach is promising for the non-destructive prediction mapping of SSC and pH in kiwifruit or other cylindrical-shaped samples.